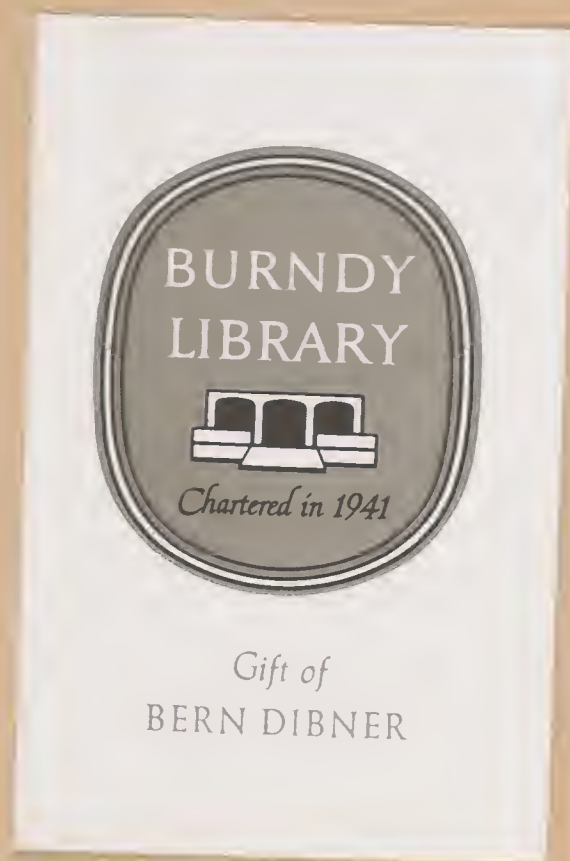


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ON THE PRINCIPIA. MSS.

- 73 NEWTON (Isaac) and CLERKE (Gilbert). Four Autograph Letters signed, from Gilbert Clerke to Isaac Newton, concerning difficulties in *The Principia* and one Autograph Letter signed from Isaac Newton in reply, written on the blank pages of one of Clerke's letters. Six pages folio and five pages 4to, in Clerke's hand, 1½ pages, 4to, in the hand of Isaac Newton. 1687 £90

*A most important contemporary correspondence between these great scientists, following immediately on the publication of Newton's "Philosophiae Naturalis Principia Mathematica." Clerke was one of the best known mathematicians of the time, the author of "De Plenitudine Mundi," 1660; "Tractatus de Restitutione Corporum," 1662; "Finalis Concordia"; "Oughtredus Explicatus"; a comment on Oughtred's "Clavis Mathematica," 1682; etc.; etc.*

*Clerke writes to Newton at considerable length, saying that he has just read his book and wishes to have a number of points explained. Newton replies: "I do not wonder that in reading a hard Book you meet with some scruples & hope that ye removal of those you propound may help you to understand it more easily." He goes on to explain the proposition which Clerke has queried, and ends: "I thank you for signifying your doubts to me in these things because they might have proved my mistakes. If there be anything else you think material for me to know or stick much at in reading ye Book, pray do me ye favour of another letter, or two. I am Your most humble servant Js. Newton."*



The work of  $\S$  17<sup>th</sup> Proposition proceeds thus. The equation first found is  $SP^2 - 2KPH + PH^2 = (SH^2 \&c) = SP^2 + 2SPH + PH^2 - L \times SP + PH$ . ~~And~~ ~~add~~ ~~also~~ ~~big~~  $2KPH + L \times SP + PH - SP^2 - PH^2$  & if first ~~part of the~~ ~~by striking out the terms~~  $SP^2$  &  $SP^2$ , ~~and~~  $2KPH$  &  $2KPH$ ,  $PH^2$  &  $PH^2$  will become  $L \times SP + PH$ , for equation will become  $SP^2 - 2KPH + PH^2 + 2KPH + L \times SP + PH - SP^2 - PH^2 = SP^2 + 2SPH + PH^2 - L \times SP + PH + 2KPH + L \times SP + PH - SP^2 - PH^2$ : & by striking out  $\S$  terms (~~which are~~  $SP^2 - SP^2$  &  $PH^2 - PH^2$ ) & destroy one another there will remain  $L \times SP + PH = 2SPH + 2KPH$ .

By sesquipedal I mean sesquialtera, a ratio & an half or of root of  $\sqrt[2]{}$  ratio triplicata. for  $\bullet$  in Coroll. 2. dem. XI, the sides DB, ~~Ab~~ are in a duplicate ratio of  $\sqrt[2]{}$  sides AD, Ad & therefore of triangles ADB, Adb which are in a triplicate ratio of  $\sqrt[2]{}$  sides AD, Ad are in half that ratio of  $\sqrt[2]{}$  sides DB ~~is~~ ~~this~~ ~~half~~ of  $\sqrt[2]{}$  triplicate ratio of ~~them~~ call ratio sesquipedal. ~~Also~~ ~~in~~ ~~Prop. XV~~ ~~let~~

the three proportionals be A. B.  $\frac{B^2}{A} \therefore$  & AB will be of rectangle sub axis & this is compounded of  $\sqrt[2]{}$  ratio sesquipedal  $\sqrt[2]{A}$  &  $\sqrt[2]{}$  ~~triplicate~~ ~~ratio~~  $\sqrt[2]{\frac{B^2}{A}}$  for ~~these~~ ~~compounded~~  $\sqrt[2]{A} \times \sqrt[2]{\frac{B^2}{A}} = \sqrt[2]{A \times \frac{B^2}{A}} = \sqrt[2]{A^2 \times B^2} = AB$ .

I thank you for signifying your doubts to me in these things because they might have proved my mistakes. If there be any ~~things~~ ~~which~~ you think material for me to know or stick much at in reading of Book, pray do me  $\sqrt[2]{}$  favour of another letter, or two. I am

Your most humble servant  
Is. Newton.

ISAAC NEWTON.  
[Part of A.L.S.].



\$ 450<sup>00</sup>

ON THE PRINCIPIA. MSS.

- 73 NEWTON (Isaac) and CLERKE (Gilbert). Four Autograph Letters signed, from Gilbert Clerke to Isaac Newton, concerning difficulties in *The Principia* and one Autograph Letter signed from Isaac Newton in reply, written on the blank pages of one of Clerke's letters. Six pages folio and five pages 4to, in Clerke's hand, 1<sup>1</sup>/<sub>2</sub> pages, 4to, in the hand of Isaac Newton. 1687 ~~6~~

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CLARKE (GILBERT) FOUR A.L.s. to Newton concerning  
Difficulties in the "PRINCIPIA",  $4\frac{1}{2}$  pp. sm. 4to and  $5\frac{1}{2}$  pp.  
folio (one letter stained)

Stamford, 26 Sep., 10 Oct., 7 Nov.  
21 Nov. 1687.

The first letter contains also an AUTOGRAPH DRAFT, SIGNED,  
OF NEWTON'S REPLY, giving a detailed explanation of the  
17th proposition:

"I do not wonder that in reading a hard Book you meet with  
some scruples and hope ye removal of those you propound  
may help you to understand it more easily .... I thank you for  
signifying your doubts to me in these things because they  
might have proved my mistakes ....."











Worthy S<sup>r</sup>

I have a desire to acquaint you with something I  
have observed in your booke & w<sup>ch</sup> may be your interest to  
know; though I confesse I doe not as yet well understand  
so much as your first three sections, for w<sup>ch</sup> you doe not  
require y<sup>t</sup> a man should be mathematicke doctur; but it  
I must not tell you, till I understand those sections & your  
third booke very well; perhaps I must never tell you  
y<sup>r</sup> booke coming to me in y<sup>r</sup> evening of my declining age.  
it is in prop<sup>o</sup>. 17. p. 59. Lem: 15. when you say addatur utrobique  
you add 2KpH. but on one side & L + Sp + PH, but once  
on y<sup>r</sup> one side & twice on y<sup>r</sup> other; upon w<sup>ch</sup> your con-  
cluding analogism both depend. If the equation  
should be rightly reduced it would be  
$$2SpH + 2KpH = 2SpH + 2KpH.$$

now I am writing, let me tell you my thoughts of prop. 15.  
where you say atq adco rectangulum sub axibus &c  
by lessiquiplic<sup>is</sup>. it appears from Cor. 2. Lem: 11. y<sup>t</sup> you  
meane y<sup>r</sup> same with triplicata so Ac is y<sup>r</sup> triplicate of A  
or lessiquipl. of Aq and by dimidiata<sup>is</sup> you meane y<sup>r</sup> root  
as p. 57. l. 3. & certainly by integra ratio, you meane A  
if I mistake y<sup>r</sup> meaning, pray let me know in a word  
or two: let therefore the three proportionals be  
$$A. B. \frac{Bq}{A} ::$$

AB. will be y<sup>r</sup> rectang. sub axibus: but I doe not see how  
this will be compounded of  $Ac \times r \frac{Bq}{A} = r Aq \times Bq$ .  
But if Ac be drawne into y<sup>r</sup> later<sup>is</sup> rectum viz  $\frac{Bq}{A} Ac = Bq Aq$   
w<sup>ch</sup> is y<sup>r</sup> rectangle sub axium quadratis  
consider whether you might not here make some accidental mistake



of y<sup>e</sup> one rectangle for y<sup>e</sup> other.

There are one or two things more in w<sup>ch</sup> I am  
not well satisfied, but y<sup>e</sup> shell being yet upon my head  
it may be too great a presumption in me to say any  
more to so able a man as you are in y<sup>r</sup> owne profession  
if it be not so already, to have said so much, for w<sup>ch</sup>  
I crave y<sup>r</sup> Pardon. Or rest

Y<sup>r</sup> most humble servant

Gill. Clarke

from my house in  
St Martins in Stamford

Sept. 26. 1687.

I have sent this letter by Mr Lawrence his some of  
Clarke by whom if you see cause you may return me  
an answer.

Y<sup>r</sup> I do not wonder that in reading a hard Book you were  
with some scruples & hope y<sup>t</sup> if removal of those you  
propound may ~~able~~ help you to understand it more easily



The work of y<sup>e</sup> 17<sup>th</sup> Proposition proceeds thus: The equation first found is  $SP^2 - 2KPH + PH^2 = (SH^2 \&c =) SP^2 + 2SPH + PH^2 - L \times SP + PH$ . ~~And~~ ~~add~~ ~~another~~ ~~also~~ ~~bigg~~  $2KPH + L \times SP + PH - SP^2 - PH^2$  & y<sup>e</sup> first ~~part of the~~ by striking out the terms  $SP^2$  &  $-SP^2$ , ~~and~~ ~~2KPH~~ &  $+2KPH$ ,  $PH^2$  &  $-PH^2$  will become  $L \times SP + PH$ , for equation will become  $SP^2 - 2KPH + PH^2 + 2KPH + L \times SP + PH - SP^2 - PH^2 = SP^2 + 2SPH + PH^2 - L \times SP + PH + 2KPH + L \times SP + PH - SP^2 - PH^2$ : & by striking out y<sup>e</sup> terms (~~and~~ ~~SP^2~~ ~~- SP^2~~ & ~~PH^2~~ ~~- PH^2~~) w<sup>ch</sup> destroy one another there will remain  $L \times SP + PH = 2SPH + 2KPH$ .

By sesquiplicata I mean sesquialtera, a ratio & an half or y<sup>e</sup> root of y<sup>e</sup> ratio triplicata. for in Coroll. 2 Lem. XI, the sides DB, Ab are in a duplicate ratio of y<sup>e</sup> sides AD, Ad & therefore y<sup>e</sup> triangles ADB, Adb w<sup>ch</sup> are in a triplicate ratio of y<sup>e</sup> sides AD, Ad are in half that ratio of y<sup>e</sup> sides DB ~~Ab~~ & this half of y<sup>e</sup> triplicate ratio I there call ratio sesquiplicata. ~~These~~ <sup>Now in</sup> Prop. XV let the three proportionals be A. B.  $\frac{B^2}{A} ::$  & AB will be y<sup>e</sup> rectangle sub axibus & this is compounded of y<sup>e</sup> ratio sesquiplicata  $\sqrt{A}$  & y<sup>e</sup> <sup>edimidia</sup> ~~edimidia~~ ratio  $\sqrt{\frac{B^2}{A}}$  for ~~these~~ ~~compounded~~  $\sqrt{A} \times \sqrt{\frac{B^2}{A}} = \sqrt{A \times \frac{B^2}{A}} = \sqrt{AB^2} = AB$ .

I thank you for signifying your doubts to me in these things because they might have proved my mistakes. If there be any <sup>thing</sup> ~~thing~~ you think material for me to know or stick much at in reading y<sup>e</sup> Book, pray do me y<sup>e</sup> favour of another letter or two. I am

Your most humble servant  
Is. Newton.



for Mr Isaac Newton  
fellow of Trinity Coll.  
in Cambridge  
These  
do











S<sup>r</sup>

I graunt, and am very glad, that you have justified your  
 proposition, and did verily beleive you would, but I told  
 you I thought it must be by reason of misprinting or mis-  
 -transcribing; as it is, I think I may be reasonably ex-  
 -cused, for although I did looke upon y<sup>e</sup> rest of y<sup>e</sup> equations  
 yet finding no fault in them, nor seeing any L<sup>h</sup> there I  
 forbore to make any strict search, nor dor I thinke my selfe  
 bound to take four quantities & goe & try y<sup>e</sup> with four  
 or 5 equations, y<sup>t</sup> went before but as is usual ~~but as is~~  
 usual I got next way to those w<sup>h</sup> are on both sides of  
 y<sup>e</sup> next note of equation; and if as you dor now you had  
 looked in y<sup>e</sup> intermediate equations with Lunulas or esprai-  
 -ally if you had said at last

for ex.  $Spq - 2KpH + C = Spq + 2SpH$  &c you had written  
 better to be understood & I thinke you will graunt me this much.  
 some other obscurities & some what else I am not so well satisfied  
 in I will tell you another time; because you will dor me y<sup>e</sup> favour

to accept a letter or two more, for w<sup>h</sup> I thanke you.  
 I perceive I collected rightly from Lem. 11 Cor. 2. y<sup>t</sup> Ac was  
 y<sup>e</sup> sesquipl. of Ag by y<sup>e</sup> 11. & 2. & by analogie with y<sup>e</sup> same  
 might have collected y<sup>t</sup> r Ac was y<sup>e</sup> sesquipl. of A. viz.  
 $A$  in  $rA = rAc$ . but by a slip of fancy when I came to prac-  
 -ise I put y<sup>e</sup> sesquipl. of Ag viz:  $Ac$  for y<sup>e</sup> sesquipl. of A. or  
 y<sup>e</sup> axis transverse; you say you meant  $rAc$  & that indeed  
 will doe, But

first whereas you say by sesquipl. you mean sesquialtera, a  
 ratio and a half, y<sup>t</sup> is not  $rAc$ . for it  $Ac$  is 4. & y<sup>e</sup> sesqui-  
 -altera is. 6. but  $Ac = rAc$ . I thought you might mean  
 & had  $A + \frac{A}{2}$  but that would not doe. I also multiplied  
 y<sup>e</sup> whole by the halfe viz:  $A \times \frac{A}{2} = \frac{A^2}{2}$  that would



now I perceive I should have multiplied y<sup>e</sup> whole not by  
y<sup>e</sup> halfe, but by y<sup>e</sup> ratio dimidiata viz.  $A \times \sqrt{A} = \sqrt{A^3}$ .  
again, how can you say

"The sides DB. Db, are in a duplicate ratio of y<sup>e</sup> sides AD. Ad  
" & therefore y<sup>e</sup> triangles ADB. Adb. which are in a triplicate  
" ratio of y<sup>e</sup> sides AD. Ad. are in halfe y<sup>e</sup> ratio of y<sup>e</sup> sides BD. Bd.

How can that be? how but halfe  $= \frac{BD}{Bd}$  is not the  
triplicate more than y<sup>e</sup> whole duplicate & as much more  
as  $\frac{BD}{Bd}$  is when it is multiplied by  $\sqrt{\frac{BD}{Bd}} = \sqrt{\frac{BD^2}{Bd^2}} =$   
to y<sup>e</sup> triangles  $\frac{ADB}{Adb}$ .

Lastly you say & this halfe of y<sup>e</sup> triplicate ratio of  
these call ratio sesquialata - you call y<sup>e</sup> ratio will  
as you use it, but here you wrong your selfe, for you  
there call y<sup>e</sup> whole triplicate viz.  $A^3$ . y<sup>e</sup> sesquial. of  $A^2$   
(that is BD. Bd.) & not  $\frac{A^2}{A}$

But so long as y<sup>e</sup> propositions, published are safe, no  
matter how you or I in private letters may miscall  
or mistake, by a suddaine flash of fancie: for I know  
I do both every body else y<sup>t</sup> you not need not my  
help to teach you these things: But I see so much already  
y<sup>t</sup> I shall need y<sup>r</sup> assistance for more propositions & Corollaries  
than I will be able in civillie course, had y<sup>e</sup> booke come  
to me 20 or 30 years agoe, I would have taken more  
paine than now I can: But now I have begunne I will  
try a little to get some generall notions about y<sup>e</sup>  
planets & y<sup>e</sup> sides I will

at march.

Octob. 3. 87.

y<sup>r</sup> most humble serv<sup>t</sup>. J. Clarke

Gillb. Clarke



I confesse I did not very well approve of your calling yr root  
by yr Dimidiata ratio; for dimidiare is properly to divide by .2.  
so Ought. & 15, 11. si dimidiandum sit 32, vel dividendum p 2.  
so Clavius lib. 5. towards yr beginning de proportionibus - unitatem  
que est pars dimidiata numeri binarii; therefore I thought that  
for most mens understanding, this ratio had been better called  
sub-duplicata; but if use amongst you virtuosi rather autho:  
vizd yr other way because there is as well  $4 \times 4$  as  $4 + 4$   
I am content.

yr carrier went sooner by my window than usually <sup>last week</sup>. & since  
I read yr 15<sup>th</sup> prop. l. 3. p. 420. & then you say - Diametri trans-  
versus sunt in ratione sesquialtera temporum period: I am sure if  
it I had not knowne what sesquialtera was, I should never have  
found it out by comparing these two propositions. for if one  
of those be in sesquialtera yr other is not. I thinke it had  
been better & more easie to be understood, if it had been called  
sub-sesquialtera; so Clavius a little before, de ratione minoris  
in aequalitatis: - non est autem hac Divisio manis &c. neq enim eadem  
est proportio 4 ad 2: quod 2. ad 4.  
I thinke yr wh you mean by sesquial: should have a name for it  
& yr sesquial: is a good name. but it cannot be allowable to  
call it sesquialtera, there being a known ratio by Addition  
as  $\frac{3}{2}$  is another thing so called: by all means let divers  
things have diverse names.

Oct: 10. 1684



The  
for the Isaac Newton  
fellow of Trinity College  
in Cambridge











I thinke in my last, I tooke notice of yr maine of what you now write viz:  
 of both addition & multiplication. But when particular quantities are  
 named & set downe, it is another thing, than if a man bring asked in  
 general, what is halfe yr duplicata ratio: should answer, that, that  
 ratio is compounded of two equal ratios, wh being twice taken, one of  
 them may in yr regard be called halfe of it. but you say  
 "ratios are summd up by multiplication, wh I cannot graunt, they  
 are compounded by multiplic<sup>n</sup>. w giveth y fact not y summe  
 "you say, yr quantity  $\frac{4}{1}$  doubled is  $\frac{8}{1}$ , but yr ratio  $\frac{4}{1}$  doubled is  $\frac{4}{1} \times \frac{4}{1}$   
 or 16. certainly mathematicians doe not use to call that doubling  
 but duplicating in contradistinction to doubling.  
 "but yr ratio dimidiata of  $\frac{16}{1}$  is yr root thereof namely  $\frac{4}{1}$   
 I thinke ratio subduplicata is a more c<sup>pp</sup>, more usual & better known word  
 "so yr quantity sesquialtera of 16 or  $\frac{16}{1}$  is 24. true! & so is yr  
 ratio also; for I doe not believe y<sup>t</sup> any mathematician did ever yet  
 call 64. yr sesquialtera of 16. but yr triplicate of 4. yr duplicate  
 of 8. yr double of 32 & you have given a good name, yr  
 sesquiplicate of 16. and perhaps then is  $A + \frac{A}{2}$  for yr sesqui-  
 altera, so then may be use of  $A \times \frac{A}{2} = \frac{A^2}{2}$ . for yr sesquialtriplicate  
 "you say, let yr quantity be A & its ratio A to 1. or  $\frac{A}{1}$  yr quantity  
 dimidiata, duplicata triplicata sesquialtera will be  $\frac{1}{2}A$   $2A$   $3A$   $\frac{3A}{2}$   
 But yr ratio &c. your But here signifies nothing, for never  
 any man called  $2A$ , but  $A^2$  yr duplicate of A. & I am persua-  
 ded not one mathem<sup>n</sup> in ten but would say y<sup>t</sup> being asked, y<sup>t</sup> 6. is yr  
 sesquialtera of 4. without yr least thought of distinguishing between  
 quantities & ratios; so Clavius proportions sesquialtera -  $\frac{3}{2}$   $\frac{6}{4}$   $\frac{9}{6}$  &c p. 360  
 & you cannot deny, but that so it is by addition & in  
 significant<sup>n</sup> famosion. as there is on yr one side of yr simple ratio,  
 dupla, tripla &c & on yr other side subdupla, subtripla &c  
 so on yr one side there is duplicata, triplicata &c & on yr other side  
 subduplicata, subtriplicata &c wh are sufficient & need no innovation.  
 to be short, when I will graunt you, y<sup>t</sup> dupla is yr same with duplicata  
 then I will graunt you y<sup>t</sup> sesquialtera is yr same with sesquiplicata.  
 ye like I say of yr explanations in lines.  
 you say you did not runne over particular; but pray once againe consider  
 whether those triangles according to your owne way of calling ratios  
 be in halfe yr ratio of yr sides BD, bd. it is in dimidiata ratione  
 or as yr roots thereof. they are in sesquiplicata ratione laterum DB, db.  
 it is A not Ac. it is in dimidiata ratione  $\frac{28}{1}$   $A^2$   $A^2$ :  
 I guesse y<sup>t</sup> a little before you wrote, you thought of multiplying DB db  
 by  $\frac{1}{2}$  &  $\frac{1}{2}$  id est by yr halfe, wh came you upon y<sup>t</sup> mistake; you see  
 I am confident, pray dismount my confidence. your letter answers very  
 prettily to what I said of a suddaine decoction of fancy for you date  
 yr letter at yr top of y<sup>t</sup> page. nov. 2. & at yr bottom you slip  
 downe just a weeke I datting it nov. 9. wh I recd: nov. 4.  
 we are nature must be subject to such things in matters of greater  
 moment.



if I say, in duplicata ratione & meane composition or multipl: of Ratios  
well I may for yr word is dedicated to that use & I have another word  
(viz) Dupla) to expresse ye double: but it by sesquialtera I meane  
composition of ratios; what word have I left <sup>that</sup> which is by addition:  
as 6. is to 4. & then what a tribe of sesqui's have I to coyne  
words for, when I say sesqui quinta I must be thought to meane  
 $\frac{5}{4} \times \frac{1}{5} = \frac{1}{4}$  but by no means  $\frac{5}{4} \times \frac{1}{5}$ : but I must say sesqui quintuplicando  
or ex ratione composita &c or best of all  $\frac{1}{4}$   
By yr way (another hint when you are at loose) pray tell me how  
you understand sesquialtera in yr tables p 403. 404. for I cannot  
of a suddaine adjust ym, neither my way nor your way.  
But lett us come to some new matter. I was much troubled, at yr conjuncti  
rationibus, by wh<sup>ch</sup> I perceive you meane multipl: viz: p. 51. L. 6. how to find  
PC + L: a 4th proportional, at last I perceivd it was but a method of  
writing & no analogism, so contracting yr ratios by changing yr  
Quad's. & setting ym in rank & file one under another, I easily saw  
how I was to multiply & divide

$LQR. Lpu :: AC. PC$   
 $Lpu. Gup :: L. Gu. &c.$  and indeed you should  
have sett ym so, for yr booke is hard enough, make it as easie  
as you can: so there should have been two prickd lines from yr  
center to yr tangents in prop. 5. p. 44. & you should have had  
marginal references ~~to~~ to Eucl. & Apoll. & been prodigal of  
per this & per that, of yr remp<sup>r</sup> & quoniam's & enlarged yr  
scholium; but you master doe not consider yr infirmities  
of yr readers, except you intended to write only to professors  
or intended to have yr booke lie moulding in library or  
other men to gett yr credit of yr inventions; the corollaries  
in your 4th prop. want a great many words; I believe yr absolute  
truth of ym I thinke I beginne to understand how from Defin. 7<sup>th</sup>  
& Lemma 10<sup>th</sup> you ground yr relative or corollarie nature of them  
upon yr reciprocal ratio of times & velocities (not yr comon one, when  
yr circle or line must of necessity be yr same for periodical times &  
velocities reciproc. as in a horse-race, wh<sup>ch</sup> because it so easily offers  
it selfe should have been obviated) but you meane of planetary  
motions (though yr prop: is de aequali motu) & descent of heavy  
bodies, by yr axis or sutably in yr ellipse; I doubt I may  
betray my ignorance, I would you woud bestow a line or two  
of explanation upon me. I doubt not but four such Gyants  
as you are have made yr 1<sup>st</sup> Coroll. sure. no question of yr  
but I doe not understand what circles have to doe with Cubes  
& I know yr will be done in lines wh<sup>ch</sup> will not be done in numbers  
& perhaps I have used unmeet numbers. but pray let me show  
you how by my numbers yr velocities should rather be reciproc. in  
diminuta ratione radiorum: as thus



Cor. 6. si quad. Temp. ut Cubi radior

$$\begin{array}{l} 4. 16 :: 729. 2916. \{ 15 \frac{541}{721} \text{ want radij. vel rad. cub.} \\ \text{cor. radij. } 2. 4 :: 27. 54. \end{array}$$

dimidiata ratio radiorum  $\frac{3}{4}$  fore

quoniam peripheria sunt ut radij. si primum Corpus in uno die integram absolvit periodum peripheria. 9. alterum in uno die plures tantum semissem peripheria eisdem, quia tempora sunt ut 27. ad 54 et velocitates sunt peripheria: semiss.  $15 \frac{541}{721}$  est.  $7 \frac{746}{751}$  fore 8.

ergo.  $9. 8 :: 3. 4.$  quod abscond. est enim  $9. 8 :: 3. 2 \frac{2}{3}.$

propias accedit. recipi.  
 $9. 8 ::$  fore  $4. 3.$

I tried it also in  $9. 36 :: 64. 256.$  <sup>quad. Tem</sup> <sup>cub.</sup> & it came to.  $4. 3 \frac{20}{27} :: 2. 2 \frac{2}{5}.$  <sup>quod abscond</sup>

but ne futor ultra cupidus, I have long lived in an obscure village, in worldly business & trade: renovations & have not been acquainted with y<sup>e</sup> brave notions of Galileo, Huygenius &c. so I despair of understanding y<sup>e</sup> booke well but I would willingly know as much as would satisfie my selfe about y<sup>e</sup> Tycho & some other phenomena; you must give me leave to talke though it be not very good sense, for I am one of y<sup>e</sup> forsathen I will be bold to say y<sup>t</sup> Dr Barrow & I contributed neare 40 years since, as much or more than any two others, to speake modestly, in disbus illis, to bring these things into pl<sup>ay</sup> in y<sup>e</sup> university. I rest y<sup>r</sup> Humble servant

Gilb. Cerhe

St martins. nov. 7. 1687.

I thought I must understand y<sup>r</sup> 11<sup>th</sup> sect. w<sup>ch</sup> I have read & doe not despair of understanding it, with a little of y<sup>r</sup> helpe w<sup>ch</sup> I will desire when I understand a little more & know better how to tell you what I would know. I looked over some of y<sup>e</sup> foregoing sections & thought I could understand y<sup>m</sup> but they would take up too much time & would be easily lost: as I experienced in two or three prop<sup>s</sup>.



He/3  
for Mr. Isaac Newton  
fellow of Trinity College  
in Cambridge

not old







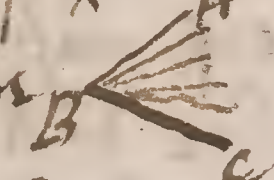




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I troubled you with a tedious letter about a fortnight ago  
and must crave your pardon for one more, you may answer  
at your owne leasure & discretion: presently after yr letter was  
gone I found my error about yr sesquialteral table 1:3. for  
intending to multiply 23. by 123. for yr 4th jovial, my eye had  
rune upon yr 3<sup>d</sup> jovial & I multiplied by 113. so all was well  
since I see how you take sesquialtera in c. 40: where you  
explaine yr selfe clearly. I have forgot how Archimedes takes  
it in his 2<sup>d</sup> & 8<sup>th</sup>. st Cyl: but certainly as yr words now go,  
being you have another word (viz. sesquiplicata) for composition  
or multiplication of ratios, it was best to cleave wholly to  
yr & leave yr other <sup>to be used</sup> case of addition only. but I submit to  
yr judgement; being confident yt as to yr manyth lem. 11. cor 2  
upon reflection you will not say yt they are in halfe yr ratio  
of yr sides  $\frac{BD}{bd}$  i.e. in dimidiata ratione or as radii: I now  
beginne to perceive yr manie of yr hypothesis of equiponderation  
& will leave farther accuracie in things yt require labour &  
time; till some other season. but I must needs crave yr pardon  
for one touch at parking: viz. concerning your Lemmata.

If your first Lemma had been thus

Quantitatem rationis, quæ ad æqualitatem dato tempo  
re constantem tendunt, sunt ultimo æquales. Who could have denied it?  
But then yr words dato tempore seem to make yr proposition identical; as if  
it were said, quantitas, quæ will be equal, will be equal. yr Asymptote  
will infinitely draw nearer & nearer but never to touch dato tempore  
But yr adding yet eo pacto — pro data quavis differentia. if upon this  
it had been concluded — nullam habent ultimam differentiam & proved  
— si neque sit earum ultima differentia D, ergo nequeunt propius accedere  
quam ex data differentia D. contra hypothesis in: who could deny it?  
If not! then your Lemma cannot be admitted; for where as you  
say, sit earum ultima differentia D. it is already proved that there  
is no such thing. & indeed all mathematicians have hitherto held yt  
that there is no such thing as quantitas indivisibilis or ultima ratio  
But you say ultima ratio quæcum evanescent p. 35. & determinor  
nothing for <sup>with</sup> which of all these lines or angles doth yr Angle ABC  
evanescent  determine which of those or any other you will a  
lesse may be given. if therefore as one sayth there is no point in operation  
can be made so, but it will have some Longitude & Latitude; yet because  
it is so little as not to be considerable in demonstration, it may be taken for  
indivisible. so if in philosophical demonstration, you had diminished ratios  
till they had been inconsiderably unequal, you might with yr consent of all  
have taken propemodum æquales & æqualibus & yr discourse about yr  
planets & sydes <sup>have</sup> been as satisfactory & acceptable, who will not be  
ent if you bring such mighty things to yr scanning.



Lemma 6. dico quod Angulus sub chorda et tangente contrahitur minuetur  
in infinitum et ultimo evanescit. who would not grant you this  
forthwith as well as for any thing you have said, in Demonstration  
of it - for whereas you say - ergo prior obtinet qd is coincidence  
that cannot be, for there is no line left coincide.

Lemma 7. & so for yr 7th lemma, after coition of yr points A, B.  
there will be no lines left for coincidence: in great circles  
a little part, is so near a straight line qd such parts of arches,  
& their tangents, would be readily granted you to be propemodu  
equal & taken for such if need be. but mathematically speaking  
if they still remaine arches, they & their tangents cannot coincide  
it being demonstrated qd a tangent can touch an arch but in one point.  
therefore this cannot be allowed for strict Geometry: I wonder at  
first qd p. 48 prop. 10, you made  $Qr = Qu$  &  $pr = pf$  qd is yr  
hypothesis to yr base, till I remember those Lemm. but however  
such things, cannot passe for strict Geometry: nor in my opinion  
need you desire it should be so accounted as you seeme to doe  
p. 35 l. 5.

the like I say of yr 8th lemma. Counting punctis A, B. Angulus  
b Ad evanescit: true. & so will yr triangles RAB, RAB, RAD.  
ye like I say of Lem. 9. for when B & C, are come to A. there will  
be no triangles ABD, ACE.  
for Lemma. 10. I see little said hitherto why you make those lines  
exponents of times & velocities, except fro yr 7th definition.

(you expone yr velocity by  $PO$  of arch prop. 16.) certainly this  
noble Lem. should have been ushered in with more words.

But in your 11th Lem. seeing Ellipses are some of ym vastly differing  
fro circles (& are yr never so near) I doe not see how it can stand  
you in much stead, for before you have finished your Demonstration  
you must bring g. to C. & make AC, yr Diameter of yr circle.  
& so by yr 31.3.2. have thrust. b. out of yr Ellipsis into yr parts  
circles with B. & then yr lines evanescence, with wh. you conclude,  
will not be same with yr nascentes, with wh. you beganne  
if I may take libertie to alter yr lines by diminishing quantities, how  
unequal forever DB & db, are; I can make ym equal, by making  
AC, yr Diameter as afore, & then bringing c. up to C. for  
CC minor esse potest quam quavis assignata &  
in yr 4th prop. you quote this Lemma of yr lineole nascentes tk ad dc  
wh. are easily and undeniably Demonstrable fro Euclid's to be as bly ad bdq  
& never yr more demonstrated by your 11th lemma, being both taken  
in yr same circle.

if you thinke any thing I have said worth yr replying, doe it when  
you find leisure: for no doubt but a great many doe often propose to  
you things of greater consequence than my skil will afford. & if you can  
without much trouble, tell me any differing notions about yr 10th Lem.  
& 4th prop. pray doe & I shall rest yr most H. serv. G. Clarke  
or any thing else



5<sup>r</sup>. our carrier is very slow & careless in delivering letters  
y<sup>e</sup> came to town on Thursday, but not delivered to me  
till I had written every syllable of it, & was just going  
to seal it to be soone enough for him;  
I perceive we agree well enough, but in a little verbality  
as you say: y<sup>e</sup> writing of the & that way in short &  
easily mistaken; if you had said in halfe y<sup>e</sup> triplicate ratio  
of y<sup>e</sup> sid<sup>es</sup> DB, db: I had readily understood you, but you  
do not at all above mention y<sup>e</sup> triplicate ratio of y<sup>e</sup> sid<sup>es</sup>  
DB db: but of AD Ad: besides y<sup>e</sup> word (that) would  
easily have carried a man to y<sup>e</sup> remotest antecedent, viz  
y<sup>e</sup> sid<sup>es</sup> DB db: first mentioned, but no more of that, I  
acknowledge this explication to be true; I assure you I had  
you y<sup>t</sup>, not as a thing I thought you did not know, but as  
I told you (in this) of my selfe how I multiplied 23. by 13  
so y<sup>t</sup> you need, now to speake to nothing but what I have  
said of y<sup>e</sup> Lemmata, in wh<sup>ch</sup> I assure you I speake my mind  
& not to Cavill, & it is my real opinion y<sup>t</sup> y<sup>e</sup> interest  
doth not depend upon y<sup>e</sup> Geometrical Demonstrations, therefore  
I will expect no answer for you this next weeke  
y<sup>e</sup> serv<sup>t</sup>. G. Cl.



These  
for Mr Isaac Newton  
fellow of Trinity College  
in Cambridge

not pd

you find  
you think  
without me  
at 4th pro,

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Letter from one Gilbert Clarke of  
 Stamford to Dr J. A. Setty forth the  
 difficulty he had to understand Dr  
 J. principia in one of v<sup>ch</sup> there  
 is a copy of Dr J's answer wherein  
 he thanks him for laying his doubts  
 before him & he says might have  
 proved mistakes in him, & offers to  
 clear & explain them —  
 Dr. who Gilbert Clarke was

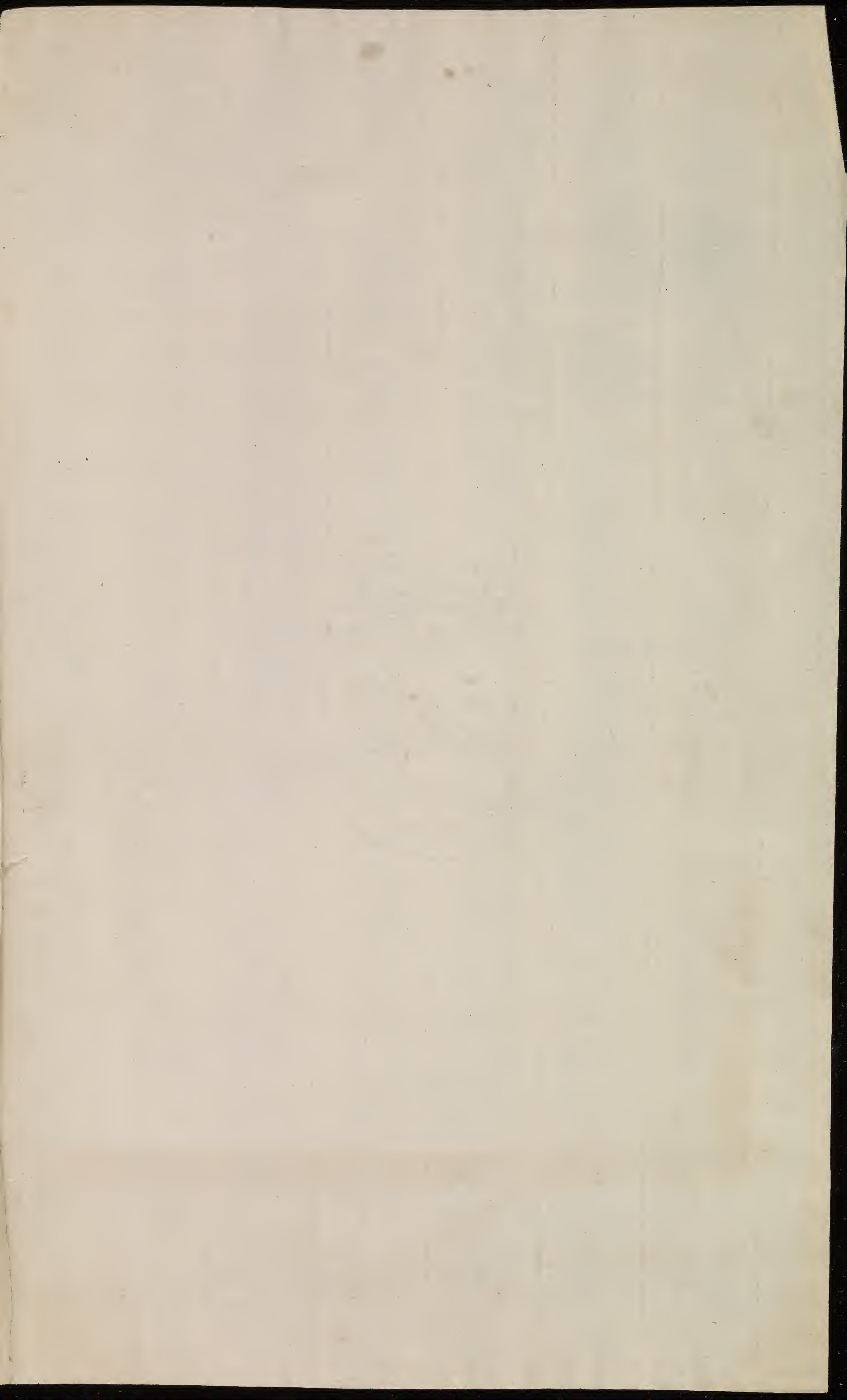
N<sup>o</sup> 7

Letters from Stur to  
 Dr Babington & Dr J. A.

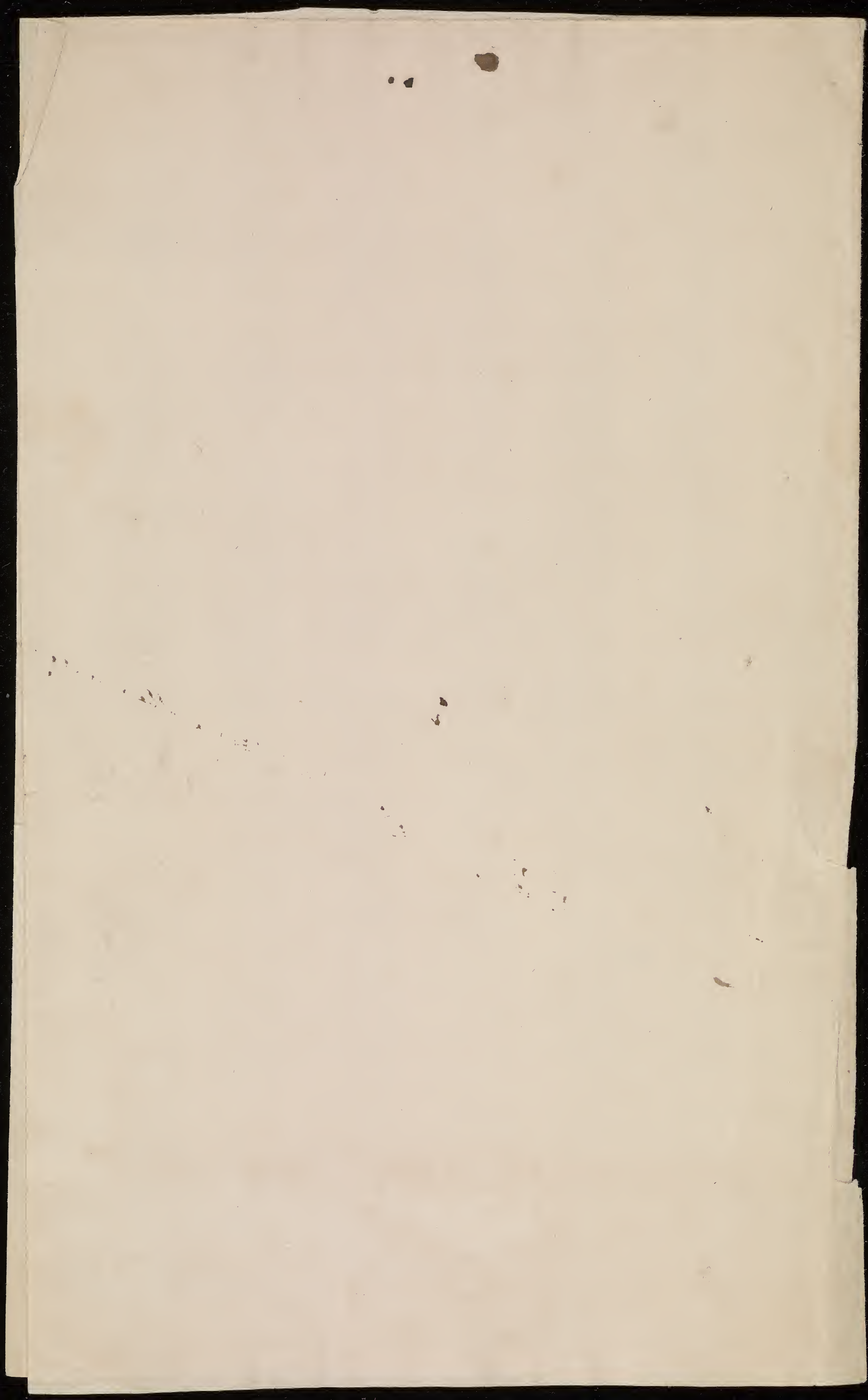


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